SLOVENSKI STANDARD
SIST EN 12308:1999

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Napeljave in oprema za utekočinjeni zemeljski plin – Preskušanje ustreznosti tesnil za prirobnične spoje na cevovodih za utekočinjeni zemeljski plin

Installations and equipment for LNG - Suitability testing of gaskets designed for flanged joints used on LNG piping

Anlagen und Ausrüstung für Flüssigerdgas - Eignungsprüfung von Flachdichtungen für Flanschverbindungen in Flüssigerdgas-Rohrleitungen

Installations et équipements relatifs au GNL - Essais d'aptitude a l'emploi des joints destinés aux assemblages par brides des tuyauteries GNL

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English version

Installations and equipment for LNG - Suitability testing of gaskets designed for flanged joints used on LNG piping

Installations et équipements relatifs au GNL - Essais d'aptitude à l'emploi des joints destinés aux assemblages par brides des tuyauteries GNL

Anlagen und Ausrüstung für Flüssigerdgas - Eignungsprüfung von Flachdichtungen für Flanschverbindungen in Flüssigerdgas-Rohrleitungen

This European Standard was approved by CEN on 7 May 1998.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 282 "Installation and equipment for LNG", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 1998 and conflicting national standards shall be withdrawn at the latest by December 1998.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies the tests carried out in order to assess the suitability of gaskets designed for flanged joints used on LNG pipes.

This European Standard is applicable for gaskets with :

- nominal pressure range from PN 16 to PN 100 ;
- nominal diameter range from DN 10 to DN 1 000 ;
- class range from Class 150 to Class 900 ;
- nominal diameter range for Class flanges from NPS 1/4 to NPS 42.

2 Normative References

This European Standard incorporates provisions from other publications, by dated or undated reference. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications shall apply to this European Standard only when incorporated hereto by amendment or revision. For undated references, the latest edition of the publication referred to applies.

EN 764	Pressure equipment - Terminology and symbols - Pressure, temperature, volume
EN 1160	Installations and equipment for liquefied natural gas - General characteristics of liquefied natural gas
EN 1333	Pipework components - Definition and selection of PN
EN 1514-1	Flanges and their joints - Dimensions of gaskets for PN-designated flanges - Part 1 : Non-metallic flat gaskets with or without inserts
EN 1514-2	Flanges and their joints - Dimensions of gaskets for PN-designated flanges - Part 2 : Spiral wound gaskets for use with steel flanges
EN 1514-3	Flanges and their joints - Dimensions of gaskets for PN-designated flanges - Part 3 : Non-metallic PTFE envelope gaskets
EN 1514-4	Flanges and their joints - Dimensions of gaskets for PN-designated flanges - Part 4 : Corrugated, flat or grooved metallic and filled metallic gaskets for use with steel flanges
prEN 1515-1	Flanges and their joints - Bolting - Part 1 : Selection of bolting
prEN 1515-2	Flanges and their joints - Bolting - Part 2 : Combination of flange and bolting materials for steel flanges - PN designated
EN ISO 6708	Pipework components - Definition and selection of DN (nominal size) (ISO 6708:1995)

3 Definitions

For the purposes of this standard, the following definitions and those given in EN 764, EN 1160, EN 1333 and EN ISO 6708 apply :

3.1 liquefied natural gas (LNG)

See EN 1160.

3.2 DN (nominal diameter)

See EN ISO 6708.

3.3 PN (nominal pressure)

See EN 1333.

3.4 NPS

A numerical designation of size used only in association with metricated flanges of ANSI origin, which is common to all components in a piping system other than those designated by outside diameter.

It is a convenient round number for reference purposes which is normally only loosely related to the manufacturing dimensions in inches.

NOTE 1 : It is designated by the letters NPS followed by a number.

NOTE 2 : The NPS cannot be subject to measurement and cannot be used for the purpose of calculation.

3.5 Class

A numerical designation for reference purposes, used only for metricated flanges of ANSI origin.

NOTE 1 : It is designated by the word Class, followed by the appropriate reference number.

NOTE 2 : The number following the word Class does not represent a measurable value and therefore cannot be used in calculations or followed by a unit.

NOTE 3: The maximum allowable pressure depends upon the Class number, the material and design of the component. The corresponding allowable temperature etc. is given in the tables of the p/T-ratings in the appropriate standards.

3.6 Class of pressure

The PN or Class of a component.

3.7 p_s (allowable pressure)

See EN 764.

3.8 Required bolting load, F_a

The load to be applied to ensure the tightness of the joint in normal operating conditions.

4 Design specifications of tested gaskets

The gasket subjected to the suitability tests defined in this standard shall fulfill the requirements of EN 1514 Parts 1 to 4, prEN 1515 Part 1 and Part 2 and wherever necessary, the requirements of EN 1160.

5 Technical documentation by the gasket manufacturer

The manufacturer shall supply the technical documentation applicable to the gasket, and in particular :

a) the dimensional characteristics of the gasket ;

b) the assembly drawings for the gasket ;

c) the required bolting load F_a of the joint designed to ensure tightness under the following conditions :

1) operating temperature ranging from -165 °C to + 60 °C ;

2) operating pressure ranging from 0 Pa to 1,15 times the allowable pressure (p_s) of the joint.

d) the thickness of the gasket and the stacking height H of the flanges (see figure C.2) after tightening with the required bolting load F_a.

When calculating the required bolting load F_a of the joint joint to the test conditions defined above, the manufacturer shall take into account the following :

- the characteristics of the selected bolting ;

- the reversible loosening of the bolting due to the differences in the thermal state of the joint components during cool-down ;

- the irreversible loosening of the bolting due to changes in the relative positioning of the joint components during the first few cool-downs.

Annex A describes the thermal and mechanical stresses to which the gasket in a flanged joint is subjected, and suggests how the joint is tightened.

6 Check of compatibility between bolting load and mechanical strength of joint components

6.1 Compatibility with flanges

It is required to check with calculations of mechanical strength that the required bolting load F_a does not generate any permanent distortion of the flanges under the conditions of thermo-mechanical stress defined in table 1.

Table 1 : Stresses to be taken into account when checking the mechanical strength of flanges

Nature of stress	Values	Cool-down
Temperature	15 °C	From 15 °C to -165 °C for the following duration : - 5 min when DN ≤ 150 ; - 15 min when 150< DN ≤ 300 ; - 60 min when 300< DN ≤ 1000
Joint internal relative pressure	1,15 x p_S	1,15 x p_S
Mechanical load	F_a	F_a

6.2 Compatibility with bolting

It is necessary to check with calculations of mechanical strength that the required bolting load F_a can be applied without generating any permanent distortion of the bolts.

Compatibility shall be regarded as demonstrated if the following condition is satisfied :

$$F_a \leq n \times F_b$$

where:

n is the number of bolts ;

F_b is the maximum allowable load of each bolt.

The load F_a shall be calculated based on the assumption that the bolt is subjected to a pure traction load, to a deflection load resulting from flaring-out of the flanges caused by the bolting, and possibly to a torsion load generated by the means of tightening the bolt.

7 Means and equipment required for testing

7.1 Test rig

Attention is drawn to european safety regulations for the design and operation of the test rig.
It shall consist of two assembled spool pieces between which the gasket to be tested is positioned.

The spools shall be fitted with branch-tees providing for :

- LNG supply ;
- draining of the test rig ;
- pressurising of the test rig ;
- measurement of temperature and pressure of the gas or LNG contained in the spools.

Annex B specifies the characteristics of the test rig.

NOTE : Liquid nitrogen can replace LNG in the spools provided the appropriate detector is used to measure the possible leakages.

7.2 Measuring equipment

The following devices shall be used to measure the conditions under which the gasket is tested :

- a hydraulic tightener or torque wrench to tighten the bolts ;

- a micrometer graduated every 0,01 mm to determine the bolting load when assembling the joint, or any other similar precision instrument ;
- a temperature probe to measure the gas or LNG temperature inside the test rig ;
- a pressure transmitter or a manometer to measure the internal pressure of the rig ;
- a gas detector with a minimum threshold of at least 10 % of the methane low flammability limit in air to detect any gas leakage from the gasket during an LNG test ;
- a temperature probe arranged at the upper periphery of one flange to check the thermal state of the joint during cool-down.

8 Testing

8.1 Application of bolting load

The joint bolting shall be tightened at ambient temperature such that the relative deviation between the achieved bolting loads and the required bolting load of each bolt shall range between 0 % and + 10 %.

The bolting load shall be verified in accordance with annex C.

8.2 Leak testing at ambient temperature

The gasket shall be checked for tightness with gas (air, natural gas, nitrogen) at 4 pressure stages for 5 min, corresponding to 0,25 x p_s, 0,5 x p_s, 1 x p_s and 1,15 x p_s.

At each of the above pressure stages, leak tightness shall be checked by applying soap suds between the flanges of the joint.

The test shall be regarded as conclusive if no soap bubble forms.

8.3 Leak testing at cold temperature

Five testing cycles shall be carried out at cold temperature in accordance with the following operational procedure :

a) fill the test rig with LNG, with filling time as specified in table 2 ;

Table 2 : Test rig filling time as a function of the DN

DN	time (t) in min
DN ≤ 150	5 ≤ t ≤ 15
150 < DN ≤ 300	15 ≤ t ≤ 60
300 < DN ≤ 1 000	60 ≤ t ≤ 120

b) cool-down the test rig by circulating LNG ;

c) stop the LNG circulation once the joint cooling rate is less than 10 °C/h over a period of 15 min ;

d) check the leak tightness of the joint ;

The check of leak tightness at cold temperature shall consist of checking for the absence of any leakage with a gas detector over the entire outer circumference of the joint, at 4 pressure stages for 5 min, corresponding to 0,25 x p_s, 0,5 x p_s, 1 x p_s and 1,15 x p_s.

e) drain the test rig to allow warming up to ambient temperature ;

f) repeat the ambient temperature test in conformity with 8.2.